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(72) Inventors:  
• **Den, Tohru**  
Ohta-ku, Tokyo (JP)  
• **Iwasaki, Tatsuya**  
Ohta-ku, Tokyo (JP)

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(74) Representative:  
**Beresford, Keith Denis Lewis et al**  
**BERESFORD & Co.**  
2-5 Warwick Court  
High Holborn  
London WC1R 5DJ (GB)

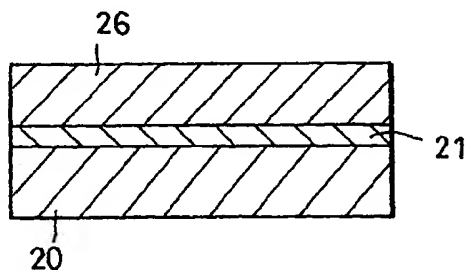
(71) Applicant: **CANON KABUSHIKI KAISHA**  
Tokyo (JP)

(54) **Carbon nanotube device, manufacturing method of carbon nanotube device, and electron emitting device**

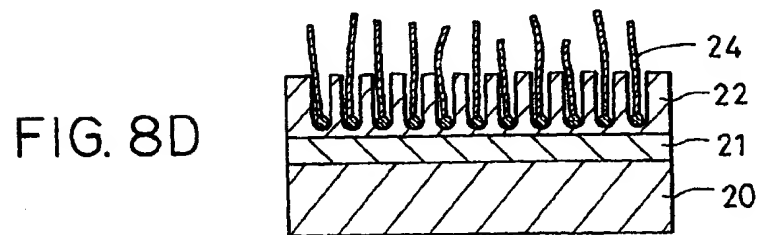
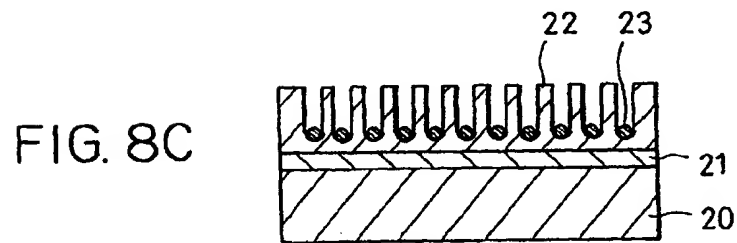
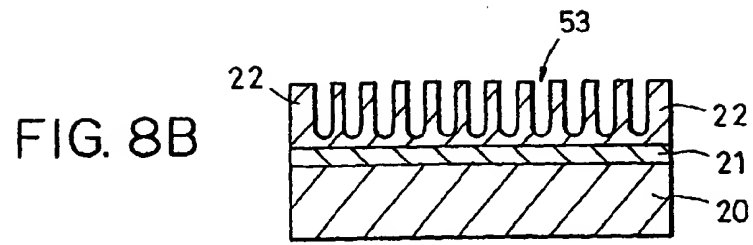
(57) The present invention discloses a carbon nanotube device comprising a support having a conductive surface and one or more carbon nanotubes, one of whose terminus binds to the conductive surface so that conduction between the surface and the carbon nanotube is maintained, wherein a root of the carbon nano-

tube where the carbon nanotube binds to the conductive surface is surrounded by a wall. Such a carbon nanotube device, having carbon nanotubes with a uniform direction of growth, can generate a large quantity of emitted electrons when it is used as an electron emission device.

**FIG. 8A**



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# EUROPEAN SEARCH REPORT

Application Number  
EP 98 30 8872

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	T. KYOTANI ET AL.: "Preparation of Ultrafine Carbon Tubes in Nanochannels of an Anodic Aluminum Oxide Film" CHEM. MATER., vol. 8, 1996, pages 2109-2113, XP000626894 * page 2109, right-hand column, line 1 - page 2113, right-hand column, line 34 *	1	D01F9/127 G01B7/34
A	EP 0 758 028 A (RESEARCH DEVELOPMENT CORPORATION OF JAPAN) 12 February 1997 * page 3, line 14 - page 4, line 49; claims; figure 1 *	1	
A	WO 90 07023 A (HYPERION CATALYSIS INT.) 28 June 1990 * page 2, line 14 - page 3, line 19 * * page 4, line 31 - page 8, line 6; claims *	1	
P, A	WO 98 05920 A (WILLIAM MARSH RICE UNIVERSITY) 12 February 1998 * page 8, line 4 - page 9, line 25; figure 1D *	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			D01F G01B C01B
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
THE HAGUE		19 February 1999	Hellemans, W
CATEGORY OF CITED DOCUMENTS			
<p>X : particularly relevant if taken alone  Y : particularly relevant if combined with another document of the same category  A : technological background  O : non-written disclosure  P : intermediate document</p> <p>T : theory or principle underlying the invention  E : earlier patent document, but published on, or after the filing date  D : document cited in the application  L : document cited for other reasons  &amp; : member of the same patent family, corresponding document</p>			

EPO FORM 1503 03/92 (P4/C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.**

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19-02-1999

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 758028 A	12-02-1997	JP 9031757 A	04-02-1997
		JP 9228160 A	02-09-1997
		US 5863601 A	26-01-1999
WO 9007023 A	28-06-1990	AU 642401 B	21-10-1993
		AU 4947390 A	10-07-1990
		CA 2005642 A	16-06-1990
		EP 0451208 A	16-10-1991
		IL 92717 A	27-02-1994
		JP 4504445 T	06-08-1992
		KR 137224 B	28-04-1998
		US 5500200 A	19-03-1996
WO 9805920 A	12-02-1998	AU 4055297 A	25-02-1998

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82